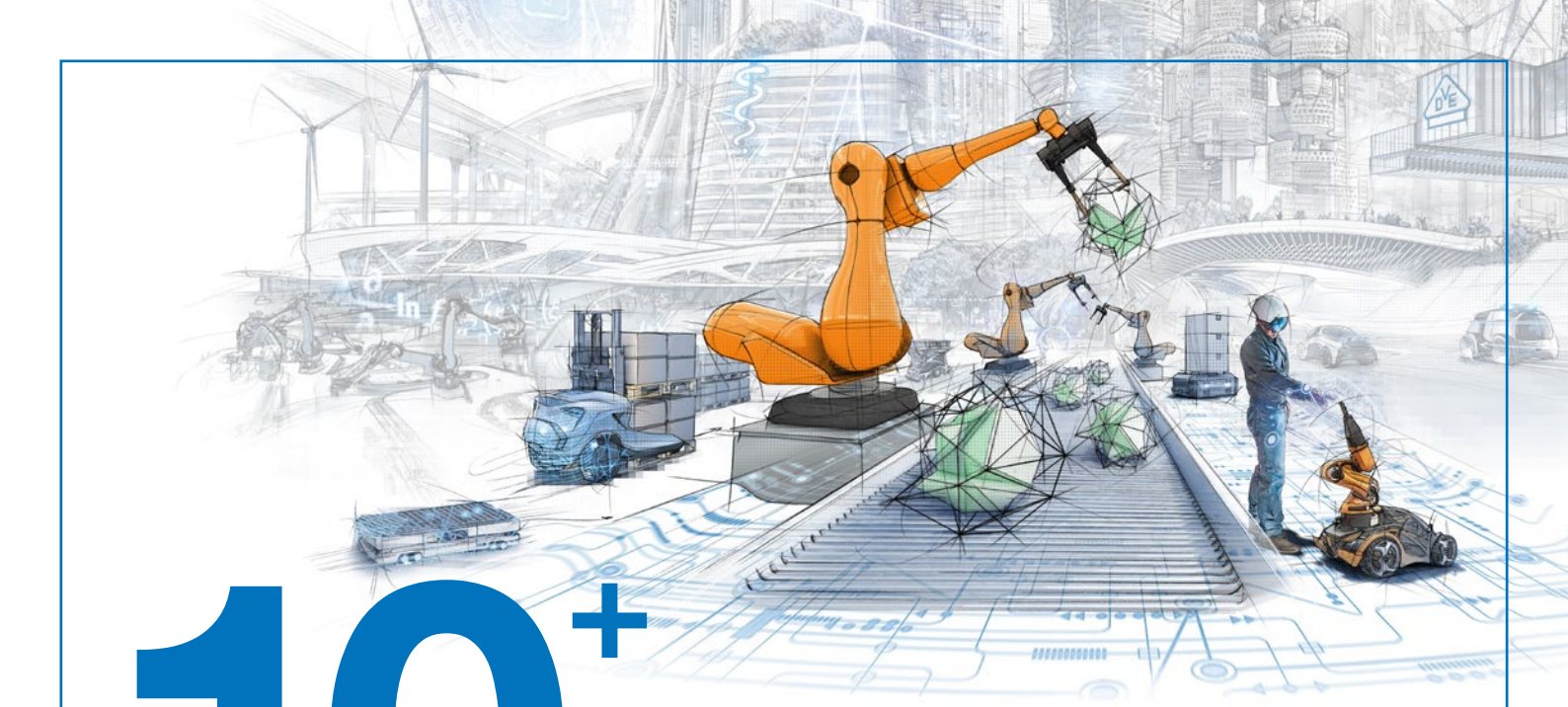


10+ years behind

EU >>>>>>>>>> Asia/USA

Establishing technological sovereignty – with a microelectronics master plan for Europe

Europe‘s gap to the world market leaders in processors, AI chips and memory components is ten years or more.

VDE policy brief

Edition 1/2021

Microchips
Europe needs a master plan 2

Technological sovereignty
What politics can do 3

Cyberattacks
Five key points for the new federal security strategy 4

Climate-neutral rail transport
Battery or hydrogen? 5

AI ethics
Label offers orientation 6

Harmonized standards
Strengthening a successful model 7

AE
What does the technology organization have to do with politics? 8
Contact 9

VDE policy brief online

VDE

Microchips

Europe needs a master plan

German automakers currently lack microchips for control electronics. The consequences are reduced working hours and production stops. This shows that Europe must do a better job of ensuring that its industry is supplied with high-tech key components, for example through its own production facilities. VDE shows how Germany and Europe should proceed.

Europe vulnerable without chip industry

Entire industries are dependent on high-performance microchips. The USA and China have long since recognized their importance for the long-term prosperity of their economies. They are specifically investing billions in microelectronics programs such as the “Chips for America Act” or “Made in China 2025”. This distorts the market to the disadvantage of European companies – and leaves them years behind the competition.

Key technologies Microelectronics and photonics

Microelectronics is currently undergoing a groundbreaking developmental step. For Europe, this is the opportunity for Europe to catch up in this key technology. Background information and communication technology (ICT): Microchips can only realize higher data rates, ranges and compactness in conjunction with photonics – optical communication. Future applications will rely on this. New opportunities are therefore emerging in the global market, which is worth billions. The potential that still exists in Germany – especially its leading position in power electronics and sensor technology – should form the basis for a comeback of microelectronics in Europe. But to achieve this, the right course must be set now:

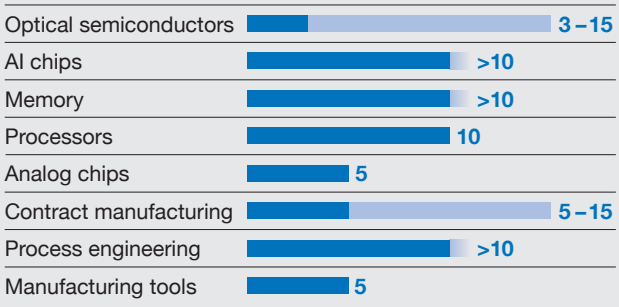
- **Align strategic industrial policy:** Europe must become a microelectronics location. A decisive, coordinated European industrial policy is needed, with sufficient funds to provide start-up financing for production facilities. Germany must take the lead in defining an "Electronics for Europe" master plan.
- **Establish own microelectronics production:** the aim is to bring essential parts of the value chain to Europe. This does not necessarily require a European manufacturer. For example, the EU can require companies to manufacture parts of the chips sold in Europe here as well, just as China has conversely been requiring for years in many sectors. In this way, expertise and production technology are secured at the location.
- **Longer-term research:** to become even more innovative, research policy should be more long-term. Evolutionary improvements can be achieved in three years; a horizon of at least ten years is necessary for disruptive innovations.
- **Promote start-ups:** Germany already has great strengths in high-tech research. However, it also needs a protected space so that innovations can be taken up by startups and established companies and turned into products.

VDE position paper
Hidden Electronics II

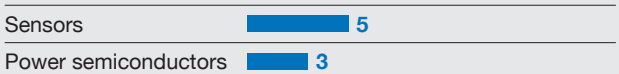
VDE position paper
Photonic-electronic integration

Europe lags behind

Europe’s deficit behind leading regions in years



Europe’s lead over other regions in years



Source: McKinsey, Handelsblatt

Technological sovereignty

What politics can do

The coronavirus pandemic catapulted technological sovereignty onto the political agenda. First, the dependence on medication and protective equipment was pervasive, especially at the beginning. Second, cyberattacks have increased by a factor of ten, another consequence of the pandemic. What does this say about sovereignty? And what should policymakers do?

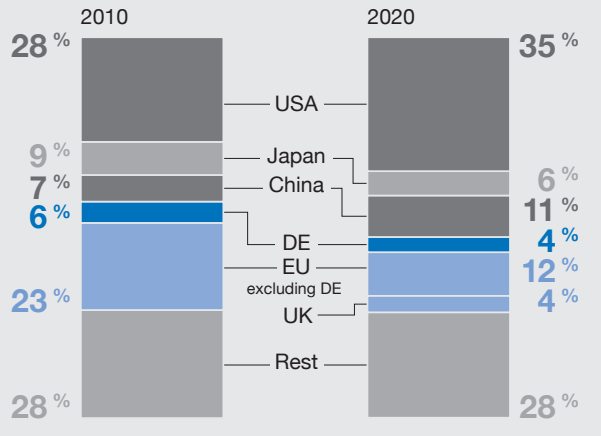
Between self-sufficiency and total dependence ...

Isolation is not a solution. Rather, it is always the degree of sovereignty to be achieved: The spectrum ranges from self-sufficiency to the targeted technology from third parties – whose mode of operation and possible risks are understood – to extensive dependence.

The degree to be achieved in each of the key technology areas must be determined on the basis of hard criteria such as security policy considerations or economic benefits. VDE has developed a comprehensive methodology for this purpose. Information and communications technology (ICT) has a special role to play: digitalization permeates all areas of life and all fields of technology like a common thread – whether in AI, medical technology or microelectronics.

Germany and Europe lag behind

ICT sales, world market shares 2010 and 2020



Sources: Bitkom, EITO, IDC

Briefly and compactly

Technological sovereignty is the ability of a state or society to implement political and social priorities without being hampered by insufficient or absent control over technologies.

Key tasks for policymakers

- **Creating knowledge:** to understand technologies, access to information, databases and international expert groups is essential. Teachers are needed who can prepare the information and get young people excited about it. The research landscape must constantly identify relevant technology fields and set appropriate priorities. One overarching priority topic is “trustworthiness” of digital infrastructure. This requires adequate resources.
- **Shaping standards:** only those who participate in international standardization bodies can ensure that desired modes of operation are taken up. Germany needs a strategically aligned standardization policy, especially in the field of ICT, software and AI.
- **Build up expertise in ICT and microelectronics:** only those who develop software and microelectronics independently can build attractive AI and Internet-of-Things applications, for example. In addition to research and education issues, policy should also aim to consistently promote open source approaches.

Technological sovereignty is a prerequisite for the continued creation of value in key technology fields in this country. This means: does Germany want to shape economic development or slip into the role of blind end user? What is needed now is a broad political discourse on what degree of sovereignty should be achieved in which fields and by what means.

VDE position paper
Technological sovereignty: proposal of a methodology and recommendations for action

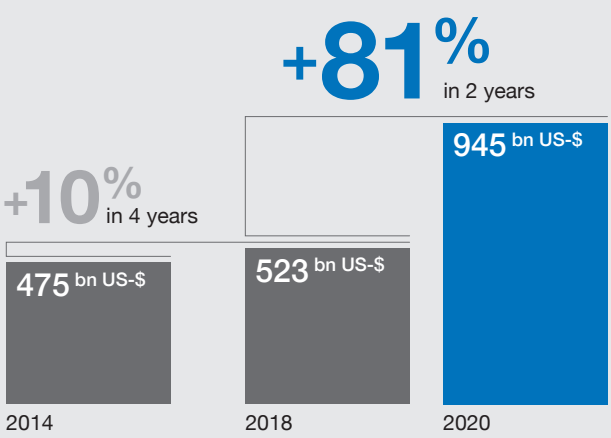
Cyberattacks

Five key points for the new federal security strategy

The Vatican, the EU Medicines Agency EMA, MDax corporations and university hospitals: they and many others have recently fallen victim to cyberattacks. The German government is alarmed and urgently needs to revise its cybersecurity strategy (CSS) – key points from VDE's point of view at a glance:

- **Faster response time:** the faster any vulnerabilities in software applications are known, the more swiftly affected companies can remedy potential threats through updates. CSS 2021 must motivate industry to make a voluntary commitment.
- **Support SMEs:** SMEs cannot master the increasing threat situation on their own, if only for resource reasons. As part of CSS 2021, incentives must be put in place for them to support each other on an independent platform in the event of IT security problems and to coordinate any measures.
- **Drive standardization and certification:** security must be a top priority for key technologies right from the development phase. The basis for this so-called security-by-design approach is international and Europe-wide standardization. State agencies such as the German Federal Office for Information Security (BSI) must be involved in this process.
- **Improve information exchange:** government and industry must work together more intensively. Exchange platforms such as UP KRITIS and standardization bodies should be used for this purpose and their work closely interlinked. Voluntary commitments by industry also contribute towards this important goal.
- **Install secure hardware:** to ensure that Europe has a sovereign and secure data infrastructure in the medium term – keyword GAIA-X – only trustworthy equipment suppliers should be used.

Costs due to cyberattacks worldwide



Source: Center for Strategic and International Studies (CSIS)

VDE has been committed to maximum cyber security for many years. This also applies to the Critical Infrastructure (CRITIS). In its standards organization DKE, for example, VDE develops global standards to ensure secure communication in the power supply sector.

Position paper by BDI, DIN and VDE DKE
Europe-wide cyber regulation

CERT@VDE: Unique platform worldwide

Politicians are rightly calling for the expansion and networking of so-called Computer Emergency Response Teams (CERTs). One role model is CERT@VDE: the organization offers German companies from key sectors such as mechanical engineering, automation technology, and other industries a globally unique environment for trusting cooperation on a non-profit basis. The industrial partners collaborate on the basis of a voluntary commitment. And in the event of specific cyber threats, they receive professional support from VDE experts.

VDE CERT
cert.vde.com

Climate-neutral rail transport

Battery or hydrogen?

Electric overhead lines are missing on 40 percent of the rail lines. In regional traffic, this is mostly compensated for by diesel multiple units. Climate-neutral alternatives are battery and hydrogen fuel cell trains. VDE has shown how their economic viability can be calculated – good for targeted climate protection investments and the taxpayer.

Three options for climate protection

Around 2,900 diesel trains currently run for Germany's local rail passenger transport system (SPNV). They account for more than a third of the total SPNV mileage. The CO_2 and pollutant emissions are correspondingly high. The alternatives are: direct electrification by closing gaps in the overhead lines, or indirect electrification with battery or hydrogen-powered fuel cell trains. There is a considerable need for advice from federal states and local authorities – especially when it comes to the economic viability of the options.

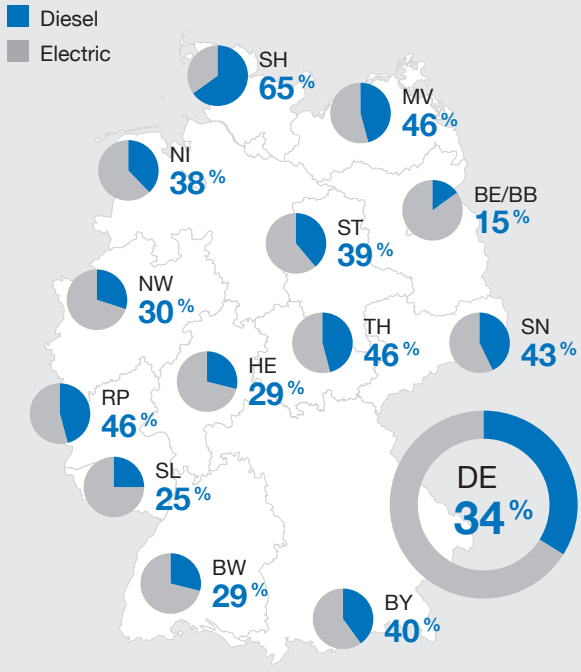
Düren network: battery train beats fuel cell train

Accordingly, VDE 2020 analyzed the Düren local transport network in NRW as a case study. The key finding: battery-electric trains can compete economically with conventional electric multiple units. At the same time, they are cheaper to purchase, operate and maintain than fuel cell trains – by tens of millions of euros over a 30-year service life. The reasons:

- **High energy costs:** green hydrogen is generated with renewable electricity at an efficiency of less than 80 percent. Efficiency losses also occur in the fuel cell of the multiple unit, so that energy requirements and costs are much higher than for trains that are operated or charged directly with green electricity.
- **High replacement costs:** in contrast to a battery train, the drive of a fuel cell train consists of several central components – fuel cell, hydrogen tank and an additional dynamic battery. This makes maintenance and replacement expensive. In addition, fuel cells have a shorter operating life than lithium-ion batteries.

VDE analysis is now an essential basis for the investment decisions of the Zweckverband Nahverkehr Rheinland.

Diesel-powered SPNV mileage per federal state



Source: SCI Verkehr

Prospects for the fuel cell train

However, this does not mean a general end to the fuel cell train: the long range could prove to be a convincing reason in other regions. For the energy system as a whole, hydrogen as a storage medium for green electricity offers the possibility of stabilizing power grids. In addition, innovative leaps can be expected in the fuel cell with regard to service life. The economic efficiency will increase. The same applies to green hydrogen itself: if it is produced on a large scale, energy costs will drop significantly.

VDE study
Evaluation of climate-neutral alternatives to diesel multiple units Economic feasibility studies using the "Düren network" as a practical example

VDE website
Alternative drive concepts for rail

AI ethics

Label offers orientation

Artificial intelligence (AI) is revolutionizing large parts of the economy. In many cases, U.S. and Chinese corporations lead the way. Often because of careless handling of AI and data. Europe wants to capitalize on this: domestic AI applications should comply with ethical principles – and cause a worldwide sensation with this promise.

Solving apparent contradictions with standardization

What data is AI allowed to analyze? Should algorithms decide on job applicants? And what about liability in autonomous driving? All too often, supposed contradictions are discussed from an economic and social perspective. VDE shows that such sensitive questions can be answered more constructively and more quickly if consensual foundations for them have already been cast in standards. This is because different interests are already taken into account in standardization processes – thanks to the involvement of all stakeholders and the consensus principle. The AI standardization roadmap processes coordinated by VDE DKE and DIN do just that and play a central role in the German government's AI strategy.

Putting AI ethics into practice

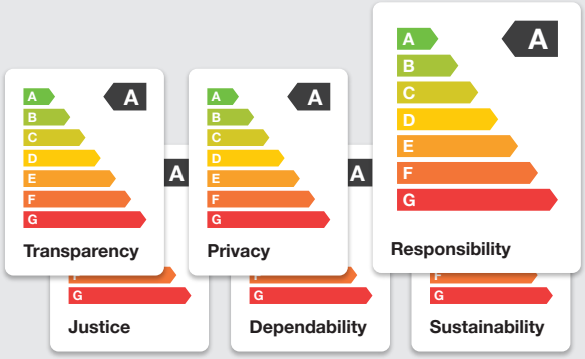
But how can ethical principles for AI be translated into practice? Terms like transparency and accountability are often too fuzzy. This is where the VDE and the Bertelsmann Stiftung come in: they lead the interdisciplinary AI Ethics Impact Group (AIEIG), which has proposed three central tools in a study:

- **Measure and Compare:** for six ethics-based categories such as transparency or accountability, the AIEIG establishes criteria, indicators and metrics. Thus, transparency can be measured by different degrees of disclosure of training data – from full automatic publication, to access only for regulators, to strict secrecy.
- **Consider application context:** logistics is less ethically sensitive in a furniture store than in a hospital. A risk matrix helps to classify AI use cases and define specific requirement profiles.
- **Communicate results:** only verifiable and certified quality provides a competitive advantage. With an AI ethics label, companies can specifically promote relevant properties of their products. Based on the EU energy label, AI ethics will be as easy to read as the efficiency classes for electrical appliances.

Brussels and Berlin want to give domestic companies the chance to score points in international AI competition through ethically tested quality. An AI ethics label offers the solution. In addition, it can considerably relieve the burden on politics and regulatory authorities: it creates transparency and at the same time avoids overregulation. The EU Commission in particular is called upon to find a happy medium between an over-simplified yes/no ethics seal, which is at best suitable for "ethics washing," and an overly complex tangle in individual cases.

Ethical evaluation at a glance

To describe the characteristics of an AI system, six dimensions are examined and presented as if modeled on the EU energy label.



Study by VDE and Bertelsmann Stiftung
AI Ethics Impact Group: From Principles to Practice. An interdisciplinary framework to operationalize AI ethics

Harmonized standards

Strengthening the success model

The EU single market is a success story. Harmonized standards across the continent play an essential role in this. The European standards organizations produce around 1,600 documents per year – efficiently, transparently and verifiably. However, the interaction between politics and standardization is currently being called into question by the EU Commission.

Politicians want to promote innovative, safe products – and are relying on EU-wide standards to do so. To this end, the EU Commission issues mandates to the European standardization organizations CEN, CENELEC and ETSI. These then work with their national counterparts such as VDE DKE, to work out the technical details – transparently and by consensus. The legal basis for this is the established New Legislative Framework (NLF).

Delays that hinder innovation

However, the EU Commission is reinterpreting its role in the standardization process on the basis of an ECJ ruling from 2016. As a result, the necessary publication of completed harmonized standards in the EU Official Journal is being unintentionally massively delayed. Key industries such as electrical engineering – where innovation cycles are particularly fast-moving – are suffering considerably as a result.

Returning to proven fundamentals

The German Federal Ministry of Economics and Technology (BMWi) has now presented a legal opinion on obligations and test limits presented by the EU Commission. Key points:

- **No equation with EU law:** in the opinion of the experts, the ECJ did not intend to equate harmonized standards with legal acts of the EU Commission. The EU Commission is thus not liable for errors in harmonized standards.
- **Limited inspection mandate:** the EU Commission should check formal aspects such as the completeness of standards before publication in the EU Official Journal. More comprehensive checks of the processes or even adoption of its own technical rules by means of legal ordinances are contrary to the European Standardization Regulation 1025/2012.

Against this background, it is incomprehensible why standards coordinated internationally and across Europe and which satisfy all requirements are delayed in appearing in the EU Official Journal. The experts believe that member states could sue the EU Commission for publications.

The European system of harmonized standards is a cornerstone of the NLF. It strengthens the European economy and contributes towards our prosperity. And their importance is growing considerably, keyword climate protection: the implementation of the Green Deal will only succeed with harmonized standards, which will then radiate all over the world. VDE DKE wants to continue working on this together with the EU Commission.

Federal Ministry for Economic Affairs and Energy
Legal opinion provides clarity on harmonized European standards

Fewer trade barriers, level playing field

Recognized European standards organizations – CEN, CENELEC and ETSI – develop harmonized European standards on behalf of the European Commission. They thus make an important contribution towards the common EU internal market in many areas, for example:

Consumer and worker protection
Cosmetic products | Toy safety

Energy efficiency
Ecodesign | Energy labeling

Chemicals
REACH | Pyrotechnic articles

Health technology
Implantable devices | Medical devices

Mechanical engineering and transportation
Interoperability of rail systems | Unmanned aircraft systems

Electrical engineering and electronics
Electromagnetic compatibility | Low voltage

Source: European Commission

VDE

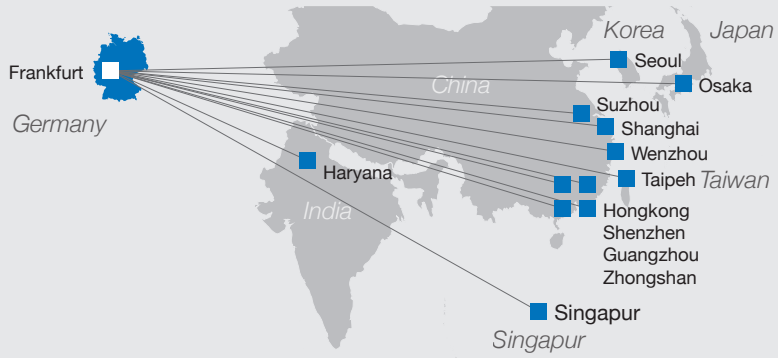
What does the technology organization have to do with politics?

What does effective climate protection look like? How do we secure cyberspace and what needs to be done to maintain Germany's innovative strength?

To answer questions of this kind, VDE offers its knowledge of technological solutions to politics and society. It is supported by over 100,000 volunteer experts – a very special kind of swarm intelligence.
In Germany, the technology organization can bring politicians together with proven experts in each individual constituency or directly in Berlin or Brussels. At the same time, VDE is active worldwide to network knowledge and contribute towards a future worth living. VDE is the only organization in the world that combines science, standardization and consulting under one roof. And thus creates specific benefits – three examples:

Present at over 60 locations

VDE networks knowledge worldwide. One focus is Asia.



- **establishing AI:** norms and standards are the key to developing innovative AI applications into export hits. In November 2020, Germany became the first country in the world to present a comprehensive analysis of this with its "Standardization Roadmap for Artificial Intelligence". Developed, among others, by the AI experts of VDE and the standards organization VDE DKE as well as the Federal Ministry of Economics.
- **Achieving the energy transition:** the energy transition will only succeed if the integration of renewables is driven forward at speed in Europe. VDE is specifying the European Network Codes in the Netztechnik/Netzbetrieb (VDE FNN) forum together with power generators, manufacturers, grid operators and science. With success – no other EU country is as far along in implementing the codes as Germany.
- **Keeping wolves away:** Some people in Germany are happy about the growing wolf population; grazing animals and their owners rather less so. How sheep, goats or horses can be protected by electric fencing in a practical and safe way was published by the VDE in mid-2020 in a standard for pasture fences.

"VDE does not pursue any self-serving interests; VDE is neutral. This makes our knowledge all the more valuable for policy. We are happy to get involved, especially in key topics such as sustainability, 'Energy of the Future' and Safety and Security."

Prof. Armin Schnettler
VDE President since July 1, 2020

"Standardization is proving that is has an essential role for product safety and the well-being of our citizens in the COVID crisis. It is time to recognize standardization as a strategic tool also in Europe, as it is already practiced for example in Germany."

Wolfgang Niedziella
VDE Managing Director and President Elect of the European standardization organization CENELEC

VDE – the technology organization

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GDE | Designing communication

Facts and figures

Founded:	**1893**
Headquarters:	**Frankfurt**
Employees:	Worldwide **2,000**
Volunteer experts:	More than **100,000**
Locations:	Worldwide over **60**
Research and funding projects:	**175**
Events per year:	Over **1,600**
Product inspections per year:	**25,000**
Electrical products bearing VDE mark:	**Billions**
Norms and standards:	Over **3,500**